

U. S. DEPARTMENT OF AGRICULTURE,

BUREAU OF SOILS—MILTON WHITNEY, Chief.

IN COOPERATION WITH PURDUE UNIVERSITY AGRICULTURAL EXPERIMENT  
STATION, C. G. WOODBURY, DIRECTOR.

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SOIL SURVEY OF DECATUR COUNTY,  
INDIANA.

BY

MARK BALDWIN, IN CHARGE, AND J. A. SLIPHER, OF THE  
U. S. DEPARTMENT OF AGRICULTURE, AND S. C. JONES,  
AND O. H. SEARS, OF PURDUE UNIVERSITY AGRI-  
CULTURAL EXPERIMENT STATION.

PART II. THE MANAGEMENT OF DECATUR COUNTY  
SOILS.

BY

A. T. WIANCKO AND S. D. CONNER, OF THE DEPARTMENT OF  
SOILS AND CROPS, PURDUE UNIVERSITY AGRICULTURAL  
EXPERIMENT STATION.

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[Advance Sheets—Field Operations of the Bureau of Soils, 1919.]



WASHINGTON:  
GOVERNMENT PRINTING OFFICE.  
1922

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## LETTER OF TRANSMITTAL.

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U. S. DEPARTMENT OF AGRICULTURE,  
BUREAU OF SOILS,  
*Washington, D. C., July 29, 1921.*

SIR: I have the honor to transmit herewith the manuscript report and map covering the soil survey of Decatur County, Ind., and to recommend that they be published as advance sheets of Field Operations of the Bureau of Soils, 1919, as authorized by law. This work was done in cooperation with Purdue University Agricultural Experiment Station.

Respectfully,

MILTON WHITNEY,  
*Chief of Bureau.*

HON. H. C. WALLACE,  
*Secretary of Agriculture.*

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## MAP.

Soil map, Decatur County sheet, Indiana.



# SOIL SURVEY OF DECATUR COUNTY, INDIANA.

By MARK BALDWIN, In Charge, and J. A. SLIPHER, of the U. S. Department of Agriculture, and S. C. JONES and O. H. SEARS, of Purdue University Agricultural Experiment Station.

## DESCRIPTION OF THE AREA.

Decatur County is situated about 50 miles southeast of the geographic center of Indiana. Its outline is irregular, but its boundaries are approximately north-south and east-west lines, with the exception of that on the southeast, which has a northeast-southwest bearing. Its greatest length from north to south is 22 miles; its greatest east-west dimension is 21 miles. The area is approximately 355 square miles, or 227,200 acres.

The surface of the county is essentially a level to undulating plain, dissected in varying degrees by the streams of the area. In general, the rougher topography is along the larger streams. Flatrock and Sand Creeks have cut valleys 50 to 100 feet deep. A wide variation in the width of the valleys from place to place is characteristic of all the larger streams of the county. A valley floor may consist of level bottom lands one-fourth to one-half mile in width, to be immediately succeeded by a narrow gorge, only wide enough to accommodate the stream bed, with steep cliffs on both sides. The smaller tributary streams have more continuous bottoms, and shallower valleys with more gentle slopes. The topography of the upland interstream areas is gently undulating for the greater part, except in the so-called "slash land" area of the southeastern part of the county, where it is flat.

According to old railroad surveys, the highest point in the county is on the summit of the divide between Sand and Salt Creeks, in the east central part of the area, and is given as 1,079 feet above sea level. The bottom of Sand Creek near where it crosses the county line is nearly 440 feet lower, and these points probably indicate the maximum extremes in elevation. The elevation at Greensburg is about 950 feet; at Westport, 800 feet; at St. Paul, 864 feet; and at New Point, 993 feet.



FIG. 1.—Sketch map showing location of the Decatur County area, Indiana.

The northwestern part of Decatur County is drained by Flatrock and Clifty Creeks and their tributaries, and the eastern part by small streams which flow into Whitewater River in the adjoining county. Although quite a large total area of Decatur County originally had poor drainage, there are very few places more than a mile from a natural drainage way. This fact, combined with a good fall in the large streams and the ease with which the soil and subsoil can be excavated, has rendered artificial drainage comparatively easy throughout the county. There is still, however, a considerable area of poorly drained land in the "slash" country. This condition and its causes are discussed in the description of the soil type occupying that region—the Clermont silt loam.

The territory out of which Decatur County was formed was acquired by the Government from the Delaware Indians by the treaty of St. Mary's, January 15, 1819. The land office surveys were completed during 1819 and 1820, and the first land patent was issued in October, 1820. The county was organized March 4, 1822. The first white settlers came chiefly from Ohio, Pennsylvania, Kentucky, and the Carolinas. The population is characterized by a high percentage of native-born whites. A colony of German immigrants settled at an early date in the southeastern part of the county, but in 1870 only 2 per cent of the 19,053 inhabitants were foreign born. The rural population greatly outnumbers the urban, although the tendency during the last 40 years has been toward a decrease in the farming population and an increase in the urban. According to the 1920 census, 70 per cent of the total population of 17,813 is rural.

Greensburg, the county seat, with a population of 5,345 in 1920, is the largest town in the county. It is the center and trading point for a rich agricultural region and has a number of factories. Other towns of importance as shipping and trading centers are Westport, New Point, St. Paul, and Adams.

A main line of the Cleveland, Cincinnati, Chicago & St. Louis Railroad from Cincinnati to Indianapolis crosses Decatur County; the Michigan Division of the same road traverses the county north and south, and the Columbus Branch runs westward from Greensburg to Columbus. The Chicago, Terre Haute & Southeastern Railroad, making connections with the Cleveland, Cincinnati, Chicago & St. Louis at Westport, crosses the southwestern part of the county. The southeastern terminus of the Indianapolis & Cincinnati electric line is at Greensburg. The county is thus provided with good transportation facilities. The railroads are supplemented by an excellent system of highways. The main interurban highways and many of the country roads are improved and surfaced with crushed limestone or gravel. A small mileage of concrete road had been built at the time this survey was made (1919).

The principal markets for produce sold outside the county are Cincinnati, Louisville, Indianapolis, and Chicago.



## CLIMATE.

The climatic data shown in the table below are taken from the records of the Weather Bureau station at Greensburg, the county seat.

*Normal monthly, seasonal, and annual temperature and precipitation at Greensburg.*

(Elevation, 954 feet.)

Month.	Temperature.			Precipitation.			
	Mean.	Absolute maximum.	Absolute minimum.	Mean.	Total amount for the driest year (1908).	Total amount for the wettest year (1915).	Snow average depth.
	° F.	° F.	° F.	Inches.	Inches.	Inches.	Inches.
December .....	31.4	65	-12	2.67	1.28	2.25	4.1
January .....	29.7	70	-17	3.17	2.20	3.03	7.2
February .....	28.2	67	-24	3.36	7.84	1.25	7.5
Winter .....	29.8	70	-24	9.20	11.32	6.53	18.8
March .....	42.1	86	0	4.58	4.00	1.25	2.4
April .....	52.8	88	20	3.42	3.66	4.32	.1
May .....	62.6	92	26	3.98	6.59	6.43	T.
Spring .....	52.5	92	0	11.98	14.25	12.00	2.5
June .....	71.2	98	36	3.38	1.88	3.74	0.0
July .....	75.6	102	42	4.39	1.84	8.07	.0
August .....	73.8	98	40	3.04	2.05	8.42	.0
Summer .....	73.5	102	36	10.81	5.77	20.23	0.0
September .....	68.3	100	26	3.20	.45	3.17	0.0
October .....	56.1	89	21	3.02	.23	1.05	.1
November .....	43.8	77	6	2.77	.59	2.33	.6
Fall .....	56.1	100	6	8.99	1.27	6.55	.7
Year .....	53.0	102	-24	40.98	32.61	45.31	22.0

The county is not subject to long periods of extreme heat or cold. High temperatures are common in July, August, and September, but are seldom of long duration. Similarly, periods of extreme cold in the winter rarely last longer than three days.

The average annual rainfall of 40.98 inches is fairly well distributed in most years. Dry weather in the late spring or summer occasionally decreases yields, but seldom or never causes total crop failure.

The length of the average growing season is nearly six months. The average dates of the last killing frost in spring and of the first killing frost in the fall are April 23 and October 17, respectively. Late frosts in spring are sometimes responsible for a partial failure of the fruit crop, and in some years they materially injure corn and garden vegetables.

## AGRICULTURE.

The agriculture of Decatur County had its beginning with the coming of the earliest settlers about 1820, and up to the present day it has been the chief industry of the county. The agriculture of the first 25 or 30 years, or until the advent of farm machinery in the early fifties, was rather crude. The clearing and making ready of the land for cultivation was a hard and laborious task. Wheat was seeded by hand and plowed or harrowed in, harvested with a reap hook, tramped or flailed out, and cleaned by hand winnowing or by hand-power machines. It was hauled to Cincinnati and other distant markets by wagons over unimproved roads, and often sold for very low prices. Thus, in the early thirties wheat brought as little as  $37\frac{1}{2}$  cents a bushel on the Cincinnati market. In spite of these handicaps the agriculture of Decatur County expanded rapidly, as is shown by the fact that in 1850, less than 30 years after the county was organized, the total population was 14,950, and the rural population approximately 12,000, or nearly as great as at the present time.

Corn, wheat, and hay were the most important crops of the early days, as they are at the present time. Flax was quite generally grown and was manufactured into homespun cloth. Considerable quantities of maple sugar and maple sirup were made, maple groves being found on many farms. Sorghum was grown for making molasses. Irish and sweet potatoes were grown for home consumption. Oats, rye, and barley were produced in limited quantities.

Cattle and hogs were kept on nearly every farm. Small flocks of sheep were kept, sheep raising being much more important than at the present time. The corn crop was practically all consumed in maintaining and fattening the stock kept on the farms, a practice that has persisted up to the present time. The sale of wheat and live stock constituted, then as now, the chief source of cash income.

The relative importance of the staple crops has changed very little in the last 50 or 60 years. The cultivation of flax has been discontinued, while alfalfa and soy beans have been introduced to a very small extent. The 1920 census reports the value of all domestic animals on farms on January 1, 1920, as \$3,309,764. The cereals produced in 1919 were valued at \$4,915,230; hay and forage, at \$1,167,944; poultry and eggs produced, at \$610,912; and dairy products, \$382,144. In 1919 the total value of all crops, including fruits, vegetables, and other special crops, is given as \$6,301,272.

A larger acreage is devoted to corn than to any other crop. The census reports 57,298 acres planted to corn in 1919, producing 2,167,250 bushels, or 38 bushels per acre. This average yield per acre is practically the same as the average yield of the last five census years. Very little corn is sold; practically all is harvested and put in silos

as silage or gathered and stored in cribs and fed on the farms to hogs, beef cattle, and other stock. More corn is shipped into the county than is shipped out.

Some of the principal varieties of corn grown in Decatur County are Boone County White, Reid Yellow Dent, Calico, Whitecap, and Riley Favorite, the three last-named varieties being grown only in the southeastern part of the county on the poorly drained land.

Wheat ranks second in acreage. The census of 1920 shows 43,970 acres devoted to wheat in 1919, with a production of 751,892 bushels, or a fraction over 17 bushels per acre. The average for the last five census years, including 1919, was 15.3 bushels per acre. The thrasher-men's reports for 1918, which was a very favorable wheat season, show an average yield of 20 bushels per acre for Decatur County. Records of some of the leading varieties made in 1918 show the following average yields:

	Bushels.
582 acres Red May (Michigan Amber) .....	22.7
1,195 acres Rudy .....	20.7
660 acres Nigger .....	18.5
4,400 acres Poole .....	20.1
1,483 acres Fultz .....	22.5
621 acres Goens (Red Chaff) .....	18.3

The census of 1920 shows 20,109 acres devoted to tame or cultivated grasses in 1919, with a production of 27,365 tons. Of all hay crops, timothy ranked first, with an area of 10,581 acres and a production of 12,862 tons. Timothy and clover mixed ranked second, with 8,062 acres producing 11,972 tons, and clover alone ranked third, with 1,291 acres and a production of 2,309 tons.

The acreage of oats has been reduced during the last 40 years. The census reports show that in 1879, 6,191 acres were sown, producing 134,894 bushels, while in 1919, 4,139 acres were sown, producing 105,881 bushels. The average yield of the last five census years was 23.9 bushels per acre. Only a very small quantity of oats is marketed, most of the crop being fed on the farms.

The last census report shows a decided increase in the acreage of rye, as compared with previous census years. Rye was grown on 3,237 acres in 1919 and yielded 36,441 bushels. The average yield for the last five census years was 11.2 bushels per acre. Practically all of the rye produced is grown in the southeastern part of the county on the poorly drained land.

Truck and other special crops are grown mainly for home use. Potatoes occupied 348 acres in 1919, yielding 11,154 bushels.

There are practically no commercial orchards in the county, although nearly every farm has a small home orchard which, as a rule, is very poorly cared for in the way of pruning and spraying. The orchards consist mainly of apple trees, with a few peach, pear, and

cherry trees. The census of 1910 reports 70,385 fruit trees, with a production of 15,238 bushels. According to the 1920 census there are 52,114 fruit trees in the county, with a total production of 10,118 bushels in 1919. Of these 34,451 are apple trees, 8,886 are peach trees, 2,743 are pear trees, and 4,104 are cherry trees. The production for 1919 was 9,279 bushels of apples, 262 bushels of peaches, 158 bushels of pears, and 279 bushels of cherries. There are 3,341 grapevines in the county, yielding 44,642 pounds of grapes in 1919. Nine acres of strawberries produced 11,430 quarts, and 6 acres of blackberries and dewberries produced 2,662 quarts. A great many wild blackberries are picked from woodland areas, mainly in the southern part of the county.

Dairying is not a very important industry. The 1910 census reports the value of dairy products, excluding home use, as \$106,102. However the industry has made some progress in recent years, and the 1920 census gives the value of dairy products as \$382,144.

Very few farmers are making a specialty of the poultry business, though small flocks are kept on all farms. Exclusive of home use, the census reports \$399,756 worth of poultry and eggs sold in 1919.

The number of domestic animals on farms in the county is reported by the 1920 census as follows: 7,522 horses, 1,943 mules, 11,208 beef cattle, 8,548 dairy cattle, 5,055 sheep, 55,835 swine. When stock is sold it is shipped to the Cincinnati, Louisville, and Indianapolis markets, the greater part going to Indianapolis.

The cultural methods practiced and the type of machinery used on the Decatur County farms are for the most part rather modern. Tractors are coming into use to some extent, especially on the better soils in the central and northern parts of the county.

Some system of rotation is followed on practically all of the lands of the county. The general practice is to plant corn, followed by wheat, and this by clover or clover and timothy mixed. In the southeastern part of the county, where the soils are acid, the rotation is often corn, wheat, and timothy.

Commercial fertilizers are used by many farmers on both corn and wheat. The 1910 census report shows that 65 per cent of the farms applied fertilizer, at a total cost of \$57,530. The State statistical report shows that approximately \$100,000 worth of fertilizers was used in Decatur County in 1917. Lime has not been used to any great extent, even on the acid soils in the southeastern part of the county.

The 1920 census gives the number of farms in the county as 1,910, averaging 121 acres each, of which 98.6 acres are improved land. The percentage of farms operated by tenants is 28.6, which is slightly under the average for the State, and also less than the percentage for the county in 1910.

## SOILS.

The wide variation in the crop-producing power of soils is one of the recognized facts of agriculture. The variation is expressed most forcibly to the average person in terms of monetary value. A range of land values within a single county, such as Decatur, from a minimum of \$10 to a maximum of nearly \$300 an acre, certainly has more than an artificial basis. It is the purpose of the soil survey to recognize, describe, and map these variations, to find out their causes, and to furnish a foundation for future agricultural work looking to the conservation and increase of soil fertility.

The soils of Decatur County have developed under the influence of a humid climate, a moderate to high summer temperature, and a moderate to low winter temperature, the warm and cool seasons being of about equal length. The high annual rainfall has prevented the accumulation of soluble salts in the soil, even in spots with poor drainage, and has leached from it the lime carbonate which is an important constituent of its parent material. On the flat areas of the southeastern part of the county the leaching of the carbonates has extended to a depth of more than 5 feet, a depth probably beyond the reach of even the deep-rooted crop plants. In the more undulating areas of the rest of the county the depth of leaching ranges from about 30 inches to 5 feet, reaching the latter figure, however, in rather small areas. As a whole, the unleached parent soil material with its abundant carbonates in the part of the county last referred to may be reached by the very deep rooted plants, such as the legumes. Over practically all the area, however, it lies too deep to have a noticeable effect on the shallow-rooted crops.

The soils of the county have been formed by the weathering of mixed rock materials containing a rather important limestone constituent accumulated in all but the southeastern part of the county by glacial action. In the latter section the soil material on the flat or so-called "slash" lands consists of a silty deposit which may have been accumulated by settling as dust from the air, or it may be merely the product of long-continued weathering of drift material—the weathering having reached such an advanced stage that most traces of the original character of the material have been obliterated. The matter becomes one of academic interest rather than of practical value.

The soils on the rolling lands of the southeastern part of the county have been derived from glacial drift, different in age from those covering the northern part of the county but differing only slightly or not at all in essential mineralogical character. The soils on the steep slopes have been derived from underlying argillaceous limestone beds.



Although the soils of the county have a similar origin in glacial drift materials, there have been developed marked differences in topography, in physical and chemical composition, and in fertility. These differences are largely due to differences in the age of the materials and to the manner of their distribution.

It has long been recognized that there were several advances of the ice sheet separated by long intervals of time. Each advance and recession left a deposit of *débris* picked up from the country over which the glacier had moved. In Decatur County, according to Leverett,<sup>1</sup> two major periods of glaciation are represented. The older of these, the Illinoian, covered the entire county, but was in turn covered by the younger Wisconsin drift over all except the southeastern quarter. The southern limit of the Wisconsin glaciation is marked in most places by a distinct change in topography, the area covered by the Wisconsin drift being gently rolling and standing in general about 20 to 30 feet above the general level of that covered by the Illinoian drift. The boundary line is well defined, the higher country dropping rather abruptly to the lower and changing from a rolling to a nearly level surface. The boundary line runs from the middle of section 15, T. 8 N., R. 8 E., northeastward by Westport to the northeast corner of the county. Southeast of this line is the region covered by Illinoian drift, northwest of it is that covered by the Wisconsin drift.

The glacial drift of the Illinoian period is relatively thin, averaging perhaps less than 25 feet in depth. The uplands generally have a covering of silt and very fine sand of remarkably uniform physical characteristics. This material is typically developed on the flat interstream areas, where it averages 6 to 10 feet in depth. Leverett and other students of glaciation in Indiana have correlated this deposit with the loessial formations of the Mississippi and Ohio valleys and have concluded that its distribution is due to the action of water or wind, or possibly both. In any event, the source of the material was glacial drift of the Illinoian or a later glacial period. This so-called loess deposit has given rise to a type of soil locally known as "slash land" and shown on the soil map as Clermont silt loam. Associated with the Clermont silt loam is a light-brown silt loam underlain at 6 to 10 inches by a light reddish brown silty clay. It occupies the slopes and better drained areas in the region of the Illinoian glacial drift and is largely derived from drift material. This type is mapped as Cincinnati silt loam. A relatively small area of soil of doubtful origin occupies the higher divides between Sand Creek and Cobbs Fork. Its topography is undulating and surface

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<sup>1</sup> Monograph LIII, U. S. Geological Survey.

drainage is well established. It apparently represents an area where the covering of Wisconsin drift was very thin and has largely been removed by erosion. This soil has been mapped as the Miami silt loam, mottled-subsoil phase.

Three-fourths of the area of Decatur County was covered by the Wisconsin glaciation. For the most part, the drift averages less than 100 feet in depth. In its deeper, unweathered parts it consists of a complex mixture of clay, silt, sand, pebbles, and boulders. The larger stones are of a wide variety; limestone, shale, sandstone, chert, and various metamorphic and igneous rocks being represented, thus indicating the extensive territory from which the glacier gathered its load. A study of the till indicates, however, that it is composed chiefly of limestone débris. It is highly calcareous in its deeper parts. The weathering in place of the typical drift material has given rise to three types of soil. A light-brown silt loam, known as the Miami silt loam, was developed in the better drained areas. Dark-brown soils, the Brookston and Clyde silty clay loams, were developed in the small, poorly drained depressions in the interstream areas, where conditions were favorable to the accumulation of organic matter.

Small areas in the northwestern part of the county are marked by a more strongly rolling topography than that of the rest of the county. They are gravelly as a rule, and in the making of the soils were subjected to drier conditions than elsewhere. The subsoil is reddish rather than brown. These areas have been mapped as the Bellefontaine loam.

The drainage of the glaciated country was much disturbed by the succeeding advances and recessions of the ice sheets. As a result of these disturbances, abandoned drainage ways, old lake beds, and high stream terraces occur throughout the glaciated country. An abandoned drainage way is found in Decatur County about 2 miles southeast of St. Paul. For a long time it was in a swampy condition, and a dark-colored silty clay loam soil was formed in the bottom, which has been correlated with the Brookston series where dark gray or dark brown, and with the Clyde where black and approaching a mucky condition. High river terraces underlain by gravel occur along the larger streams. The soil of these terraces has been mapped as Fox loam. The present-day first-bottom soil is brown loam to fine sandy loam and has been correlated as Genesee loam.

Soils are grouped into series on the basis of origin, color, topography, and structural characteristics. Each series is divided into types on the basis of texture of the surface soil. Eight series are recognized in Decatur County, and each series is represented on the soil map by one type.

The area and distribution of the soil types in Decatur County are shown on the accompanying soil map. The table below gives the name and actual and relative extent of each soil type mapped:

*Areas of different soils.*

Soil.	Acres.	Per cent.	Soil.	Acres.	Per cent.
Miami silt loam.....	128,960	58.4	Brookston silty clay loam.....	9,472	4.2
Rolling phase.....	2,048		Fox loam.....	2,176	0.9
Mottled-subsoil phase.....	1,664		Clyde silty clay loam.....	1,728	0.7
Cincinnati silt loam.....	13,824	14.0	Bellefontaine loam.....	256	0.1
Broken phase.....	17,856				
Clermont silt loam.....	31,104	13.7	Total.....	227,200	.....
Genesee loam.....	18,112	8.0			

#### MIAMI SILT LOAM.

The Miami silt loam consists of 9 to 12 inches of a light-brown silt loam, which becomes browner in color when wet. The soil is usually somewhat deeper over the crests of ridges and over the level or depressed areas than over the slopes, where a large proportion of the silty material has been washed off. The subsoil is a light yellowish brown, compact silty clay loam, containing some sand and gravel and showing dark iron stains at depths between 18 to 36 inches. At 36 inches it becomes friable and gritty and grayer, with evidence of unweathered till at 40 inches. A few crystalline pebbles and fragments of chert occur on the surface and through the soil section.

The Miami silt loam is the predominating soil type of the upland in the northern and western two-thirds of the county. The line of division between this area and that of the soil types lying to the southeast is rather marked and very noticeable, not only in the character of the soils, but in the character of the vegetation as well.

In the main, the topography of the Miami silt loam is undulating to gently rolling. Two areas, however, are exceptions to this rule. One of these areas lies along the streams, where the slopes are narrow and steep in places and contain more or less gravel and some small boulders. The other exception is the area of rather flat land lying in part north and in part southwest of Milford. In the undulating and more level areas numerous very small patches of black soil are found.

The native forest growth on the Miami silt loam consists of red oak, white oak, sugar maple, walnut, ash, and beech.

From the standpoint of area the Miami silt loam is by far the most important soil type in Decatur County. It is also highly valued for agriculture because of the variety and quality of crops



which it produces. Corn is the chief crop, and wheat, oats, timothy and clover mixed, and clover are extensively grown. It is also a good bluegrass soil.

Wheat and oats are usually sown on corn land, wheat being generally drilled in the standing corn with a one-horse drill. Corn and oats are practically all fed and the manure returned to the land.

Corn on the Miami silt loam yields from 45 to 75 bushels, wheat 15 to 25 bushels, oats 25 to 65 bushels, and timothy and clover from  $1\frac{1}{2}$  to  $2\frac{1}{2}$  tons of hay.

Commercial fertilizers, especially acid phosphate, are quite generally used on both wheat and corn. From 100 to 200 pounds is applied for wheat and about 100 pounds for corn.

Modern farm implements, including some gasoline tractors, are in use on the farms on the Miami silt loam. The farms are well fenced, and as a rule the farm buildings are well constructed and painted. Most of the farmers follow fairly well-defined crop rotations. The standard rotation is corn, wheat, and timothy and clover or clover alone. The feeding of the corn, oats, and hay crops and utilizing the manures, the use of acid phosphate, and the rotation of crops are apparently maintaining the fertility of the Miami silt loam fairly well.

The price of farm land on the Miami silt loam ranges from \$150 to \$250 an acre, depending upon improvements and location.

*Miami silt loam, rolling phase.*—The surface soil of the rolling phase of the Miami silt loam is a light-brown silt loam 6 to 8 inches deep. The subsoil is a light reddish brown silty clay or clay loam containing some sand and gravel in the lower parts. Glacial till is encountered at 3 to  $3\frac{1}{2}$  feet in places. The surface and subsoil may carry some gravel.

The rolling phase of the Miami silt loam differs from the typical soil in its more rolling to hilly topography. It is found along the larger streams, particularly Sand Creek. Many small and narrow areas along the banks of other streams are not shown on the soil map because of their small extent.

The rolling phase of the Miami silt loam is not valued so highly as the typical soil because of its less favorable topography. It is not so largely used for general farming, and a much greater proportion of its area is in pasture and woodland.

*Miami silt loam, mottled-subsoil phase.*—To a depth of 10 to 15 inches the Miami silt loam, mottled-subsoil phase, consists of a light-brown smooth silt loam, the immediate surface being light gray when dry. The subsoil to a depth of about 24 inches is a mottled light-brown and gray silty clay, underlain by a friable silty clay, largely rusty brown in color as the result of iron stains.

This phase occupies only two small areas in the county. The larger area is on the divide between Sand Creek and Cobbs Fork. The smaller is about 2 miles south on a divide between Sand Creek and a small tributary.

The topography is gently undulating to rolling, and the surface drainage is generally well established.

Most of the area of the Miami silt loam, mottled-subsoil phase, is under cultivation, being devoted to the production of general farm crops. It is apparently not so productive as the typical Miami silt loam. The areas are almost entirely surrounded by rougher land, which influences the value.

#### BELLEFONTAINE LOAM.

The Bellefontaine loam, to a depth of 8 or 10 inches, is a reddish-brown loam to sandy loam or gravelly loam. The subsoil is a reddish-brown friable yet sticky loam, containing a relatively large percentage of calcareous sand and gravel, which increases in amount with depth to about 30 inches, where a bed of pure gravel is encountered. The gravel consists of various sized fragments of chert, sandstone, limestone, and crystalline rocks. In color and character of material the Bellefontaine loam is very similar to the Fox loam, the main differences lying in their topography and respective positions, the Fox loam being developed on terraces, whereas the Bellefontaine is developed in the upland on moraines and eskers.

The Bellefontaine loam occurs in Decatur County in very small areas, the largest of which contains only 40 or 50 acres. It is found on scattered morainal hills in the northwestern corner of the county around St. Omer and in narrow, eskerlike ridges northwest of Burney.

Owing to its situation on high, rolling areas, the type has good surface and subsurface drainage. Practically the same crops are grown, and the yields are about the same, as on the Miami silt loam. The Bellefontaine loam is considered a better clover and alfalfa soil.

#### BROOKSTON SILTY CLAY LOAM.

The surface soil of the Brookston silty clay loam consists of a dark-brown to black silty clay loam from 9 to 15 inches deep. When dry the soil has a grayish cast, when wet it is black in color and rather plastic in structure. The upper subsoil is a layer of drab silty clay, usually 3 to 6 inches thick, underlain by mottled drab, rusty brown and yellow silty clay. The yellow color becomes more pronounced with depth. At 30 to 36 inches grains of sand and gravel become prominent, and the material is more friable.

The type is fairly uniform throughout the county, but owing to differences in position, natural drainage, and local treatment, it has

certain variations in color, texture, and depth of soil. The texture is heaviest in the larger, shallower basins. The color is darkest in the deeper depressions, where conditions have been most favorable for the accumulation of organic matter.

The Brookston silty clay loam occupies irregularly outlined depressions in the upland of the Wisconsin drift area. It is most extensively developed in the northwestern part of the county.

The surface of the type is lower than that of the adjoining areas, and the level topography and the position on the broader divides has resulted in poor natural drainage. Because of the semiswampy condition during much of the year, the Brookston silty clay loam was largely brought under cultivation at a later date than the surrounding areas of Miami silt loam. Recognition of its fertility has been followed by extensive artificial drainage, and now practically all the type is cleared and underdrained with tile and ranks as the best general farming land of the county. The original forest growth consisted of black walnut, white oak, black oak, ash, sugar maple, tulip poplar, elm, and some beech.

The Brookston silty clay loam is regarded as the best upland corn soil in Decatur County. Yields run consistently around 40 to 60 bushels per acre, and yields of 90 to 100 bushels have been reported. Oats yield from 30 to 50 bushels per acre, with heavy straw. There is a tendency for oats to lodge on this type in wet seasons. Wheat does not yield so well as on the lighter colored Miami soil. It is more subject to heaving and to injury from ice and standing water, especially upon the more poorly drained areas. The heads do not fill as well, although a heavier straw is usually produced. Forage crops and grasses do well upon the Brookston silty clay loam. The yield of timothy hay is heavier, but the quality is not so good as upon the lighter colored soils.

The same general rotations and fertilization are followed upon the Brookston silty clay loam as upon the Miami silt loam areas adjoining, except that corn is more often raised for two or more years in succession. It has been found that the use of 100 to 200 pounds of potash per acre improves the yields.

The irregular distribution of the Brookston silty clay loam makes it impossible to assign to it a separate and definite value. Improved farms, consisting of mixtures of Brookston and Miami soils in the western and northern parts of the county are among the highest priced farms in the county.

#### CLYDE SILTY CLAY LOAM.

The surface soil of the Clyde silty clay loam, 9 to 15 inches in depth, is prevailingly a black silty clay loam, though when dry the color is dark gray with a brownish shade, and when in the moist

condition ranges from very dark brown to black like the true muck soils. The dark color is due to the presence of large quantities of organic matter. The subsoil begins as a dark-gray, mottled silty clay loam, changing within a few inches to a light-gray or bluish-gray silty clay, mottled with yellow and brown, and of a rather tough nature but only slightly plastic. At a depth of 30 inches there is a change to a more friable, mottled yellow and gray clay loam, and at about 3 feet grayish calcareous material is reached, this being the glacial till only slightly weathered.

The type occurs in small, scattered areas in the northern part of the county. It is developed in depressed areas where fair drainage has prevailed for a long time. Some of the most pronounced depressions are occupied entirely by the Clyde silty clay loam, while others have this soil only in the lower spots and the Brookston silty clay loam in the slightly elevated positions. In mode of occurrence and characteristics the Clyde silty clay loam is intermediate between the Brookston silty clay loam on the one hand and shallow muck on the other.

Originally in a semiswampy condition, practically all the Clyde silty clay loam has been drained artificially and brought under cultivation. It is used principally in the production of corn, oats, and hay, the yields of which equal those obtained on the Brookston silty clay loam. Wheat does not do as well as on the better drained Miami soils.

#### CINCINNATI SILT LOAM.

The Cincinnati silt loam, to a depth of 8 to 12 inches, is a light-brown, smooth, mellow silt loam. The subsoil in the upper part is a brownish-yellow, heavy silt loam, but grades within a few inches into a more compact, light reddish yellow, friable silty clay loam or heavy silt loam, which extends to a depth of 20 to 24 inches. Below this depth the subsoil becomes looser in structure and somewhat mottled, the mottled layer being seldom more than 6 inches in thickness, giving way below to a heavier and tougher, dull yellowish brown or brownish-drab silty clay loam.

The variation in color is dependent upon the thoroughness of the drainage. Where the land is sufficiently rolling for the drainage to be exceptionally good, oxidation has been more active and the soil has a marked reddish cast, whereas in places where the land is less rolling and the drainage is not so thorough, the oxidation and aeration have been impeded and the soil is grayer in color and grades toward the Clermont type. It is underlain by from 20 to 30 feet of till, containing fragments of chert and of crystalline rocks. Chert and gravel are found in places in the surface soil, especially on the more sloping areas.

The Cincinnati silt loam is found on the upland plains and slopes in the northeastern part of the county, east of Lake McCoy, Kingston, and Clarksburg. South of this area it is developed along the streams in narrow strips from one-quarter to one-half mile wide on the slopes.

The topography ranges from undulating or gently rolling to rolling. In places on the more rolling slopes, where it has been poorly cared for, much of the surface soil has been washed away, though not much gullyng has taken place. Surface drainage is good, and the underdrainage is fair to good, except in the flatter areas.

About 75 per cent of this type is under cultivation. Some patches of forest remain on the slopes and in some cases on the rolling plains, the trees being mostly beech, although some oak, maple, and walnut occur.

The Cincinnati silt loam is utilized for growing corn, wheat, and grass for hay and pasture. Corn yields from 20 to 40 bushels per acre, wheat from 10 to 15 bushels, and hay from 1 to 2 tons per acre. Most of this land is acid, and for this reason very little clover is grown. Most of the hay is made from timothy, to which the soil seems to be especially adapted. The most common rotation practiced on this type is corn, wheat, and timothy, with the result that it is generally deficient in organic matter, especially in the older fields. Clover is often seeded with the timothy, but because of the acid condition of the soil it is usually a failure, except where barnyard manure or liberal quantities of commercial fertilizers are used.

*Cincinnati silt loam, broken phase.*—The broken phase of the Cincinnati silt loam, to a depth of 5 to 7 inches, is a light reddish brown silt loam. The subsoil is a light-red to reddish-brown, friable silty clay.

This phase of the Cincinnati silt loam differs from the typical soil in topography, being rolling to broken rather than undulating to rolling, in its better drainage, and in more complete oxidation of the subsoil, as shown by the more reddish color and the absence of mottling.

This soil is subject to damage by erosion, and many areas, having been cleared and cultivated, have been at least temporarily ruined by deep gullies and washes. Much of the land of this phase has remained uncleared, and a large part of that which has been cleared has grown up in sprouts and briars. Where properly cared for, good pastures have been developed on the more gentle slopes.

#### CLERMONT SILT LOAM.

The surface soil of the Clermont silt loam is a smooth, compact, gray to almost white silt loam, 12 to 15 inches deep. When wet it is gray, with a brownish cast, but when dry it is almost white. Occasional small iron concretions and angular fragments of chert are



found on the surface and intermingled with the soil. The subsoil, to a depth of 3 feet, is a gray, mottled with yellowish brown and brown, compact, friable silty clay loam. Between the typical surface soil and the subsoil there is in many places a subsurface layer of white floury silt loam. The material, though loose and friable when dry, seems to have the effect of greatly retarding the circulation of moisture and air. The same is true to a great extent of the subsoil under natural conditions.

The Clermont silt loam is developed in the southeastern part of Decatur County. It is the predominant type of the uplands of this part of the area, occupying the broad, flat, interstream areas. Natural drainage is poor throughout, owing to the level topography and the peculiarly impervious subsoil. The natural drainage system of the region is, however, sufficiently developed to provide outlets for artificial drainage, and many open and tile ditches have been constructed. Artificial drainage has in most cases met with only moderate success on account of the silting of the drains.

The type is locally known as "slash" or "white clay" land. The original forest vegetation is characterized by the prevalence of sweet gum and beech trees. Other trees are white oak, red oak, black oak, and swamp maple. More than half of the area mapped is under cultivation. The yields vary greatly according to the season and the skill and industry of the farmers. For this reason it is difficult to determine the average yields of the main crops. Corn ordinarily yields 15 to 30 bushels per acre, although practically total failures are known to occur. On the other hand, with proper drainage, fertilization, and cultivation, 70 to 80 bushels an acre have been obtained. Wheat yields are relatively higher than corn yields, more nearly approaching those obtained on the better soils of the county. Timothy is one of the most successful crops on this Clermont soil, fair yields of hay of good quality being obtained. Clover and bluegrass are grown only upon the better drained and more highly improved lands.

#### FOX LOAM.

The surface soil of the Fox loam consists of a brown loam 10 to 12 inches deep, normally containing enough sand to give it a slightly gritty feel and in places carrying some gravel. The subsoil is a dark reddish brown, coarse, sandy clay loam containing some coarse gravel and fragments of calcareous material, underlain at a depth of about 20 inches by a substratum of gravel and small boulders of chert, limestone, and other rocks, which continues in places to a depth of 20 feet or more.

The Fox loam occupies second bottoms or bench-like terraces along the main water courses, the most important areas lying along

Flatrock Creek in the northern part of the county and along Sand Creek in the southern part.

In the main the topography is flat, though in places the terraces have been dissected by lateral streams. The natural drainage is good.

Owing to its friable structure the soil is easily worked. It is fairly retentive of moisture and is considered an excellent soil for farming, practically all of it being under cultivation. Corn, wheat, and hay are the principal crops. It is rated as a good wheat soil, and it would be an excellent soil for early truck crops, though because of its geographical location it has not been used to any great extent for trucking. It is also suited to alfalfa and clover.

Corn yields 40 to 60 bushels, wheat 15 to 30 bushels, and hay 2 to 3 tons per acre.

#### GENESEE LOAM.

The surface soil of the Genesee loam is a light-brown to brown loam 12 to 16 inches deep. The subsoil is also a light-brown loam, containing a little more clay as a rule, although layers of sand, fine sand, or silty materials may be encountered at varying depths.

The type occupies the first bottoms along all the streams in the county. In most cases these bottoms are narrow, varying from 10 to 20 rods in width, but in places along the larger streams, as in parts of Sand, Clifty, and Flatrock Creeks, they are considerably wider.

The topography as a rule is level, though the natural drainage is good. Much of the land is overflowed during freshets and high water, but the streams have a rapid fall, and the overflow water is soon removed.

Corn is the chief crop on the Genesee loam. Wheat is grown in places on the wider bottoms. Clover and timothy are grown for hay and pasture. Much of the area of narrow bottoms is included in pastures with the narrow, steep slopes of the adjoining upland.

The Genesee loam produces on an average the highest yields of corn of any type in the county, the yields ranging from 40 to 80 and sometimes 100 bushels per acre.

#### SUMMARY.

Decatur County is situated in the southeastern part of Indiana. It has an area of 355 square miles, or 227,200 acres.

The topography varies from flat to undulating, rolling, and hilly. The hilly or badly eroded areas are mainly along the streams in the southeastern part of the county.

The county is drained by Flatrock, Sand, and Clifty Creeks, and their tributaries. The drainage for the most part is well established.

The mean annual temperature of the county is 53° F., while the

highest temperature recorded is 102° F., and the lowest is —24° F. The average yearly precipitation amounts to 40.98 inches. There is a normal growing season of about 180 days.

Decatur County has a total population, according to the 1920 census, of 17,813, of which 70 per cent is rural. Greensburg, the county seat and the largest town in the county, has a population of 5,345. The county is well provided with transportation facilities and has many miles of good roads.

The agricultural development of Decatur County began about 1820. Corn, wheat, and hay have always been important crops. The production of live stock, especially hogs and cattle, is an important industry.

Commercial fertilizers are used to a considerable extent, and most farmers practice some system of crop rotation.

The census for 1920 reports 1,910 farms in the county, with an average size of 121 acres. Of these 70.7 per cent are operated by owners.

Eight soil types and three phases are mapped. They are classed into three general groups—the upland, terrace, and first-bottom soils. The upland soils comprise types of the Miami, Brookston, Clyde, Bellefontaine, Cincinnati, and Clermont series; the terrace soils are classed in the Fox series, and the first bottoms in the Genesee.

The Miami silt loam is the predominating soil type of the county. It occurs on the undulating to gently rolling upland in the northwestern two-thirds of the county. It has been formed by the weathering of calcareous till. It is very productive, giving good yields of corn, wheat, clover, and timothy. The rolling phase of the Miami silt loam occurs only in a few small areas along streams and is utilized mainly for grazing. The mottled-subsoil phase of the Miami silt loam differs from the type in the subsoil, which resembles that of the Cincinnati silt loam.

The Bellefontaine loam occurs only in very small areas in the northwestern part of the county on scattered morainal hills and esker-like ridges. It is good for corn and wheat and is especially suited for clover and alfalfa.

The Brookston silty clay loam occupies irregularly outlined depressions occurring throughout the Miami silt loam area. It has been formed under swampy conditions and is rich in humus. It is the best corn land in the county, although it is not considered as good for wheat as the Miami.

The Clyde silty clay loam occurs in depressed areas in association with the Brookston silty clay loam. The two have about the same crop adaptations.

The Cincinnati silt loam occurs on the rolling plains in the north-



eastern part of the county and on the gentle slopes in the Clermont area. It is a smooth, friable soil, rather low in organic matter, and is also acid. The crops and cultural methods are similar to those on the Clermont silt loam, but the results are slightly better because of better drainage. The broken phase of the Cincinnati silt loam occurs in the more broken areas of the Clermont and Cincinnati soils. It is subject to erosion, and its best use is for pasture.

The Clermont silt loam occupies the broad, flat, interstream areas in the southeastern part of the county. The natural drainage is very poor, and the soil is very acid. In the natural state the land is rather unproductive. Corn, wheat, and timothy are the principal crops grown.

The Fox loam occupies terraces along the streams. Its lower subsoil consists of calcareous gravel. It is a good soil for wheat, corn, and clover.

The Genesee loam owes its origin to the deposition by streams of recent-alluvial material derived from all the upland soil types in the county. It occupies first bottoms, and much of it is subject to overflow. It is one of the most productive soils in the county. Corn is the chief crop.



## PART II. THE MANAGEMENT OF DECATUR COUNTY SOILS.

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### INTRODUCTION.

The farmer must know his soil and have a sound basis for every step in its treatment. Building up the productivity of a soil to a high level in a profitable way and then maintaining it is an achievement for which every farmer should strive. The business of farming should be conducted as intelligently and as carefully as any manufacturing business where every process must be understood and regulated, from the raw material to the finished product, in order to be uniformly successful. The farmer's factory is his farm and the soil is his basic raw material, which he must know how to treat and handle. Every different soil presents different problems that must be studied and understood in order to produce crops in the most satisfactory and profitable way.

It is the purpose of the following discussion to call attention to the deficiencies of the several soil types of the county and to outline in a general way the treatments most needed and most likely to yield satisfactory results. No system of soil management can be satisfactory that does not in the long run produce profitable returns. Some soil treatments and methods of management may be profitable for a time but ruinous in the end. One-sided or unbalanced soil treatments have been altogether too common in the history of farming in this country. A properly balanced system of treatment will make almost any soil profitably productive.

### CHEMICAL COMPOSITION OF DECATUR COUNTY SOILS.

The following table gives the results of chemical analyses of the soils of the different types in Decatur County in pounds per acre 6 inches:

Three groups of analyses are given; total plant-food elements, elements soluble in strong (sp. gr. 1.15) hydrochloric acid, and elements soluble in weak (fifth-normal) hydrochloric acid.

The total plant-food content is valuable in indicating the origin of the soil more than the fertility. This is particularly true of potassium. The amount of total potassium in soils is seldom an

indication of the need for potash. Some Indiana soils have over 30,000 pounds of total potassium per acre in the surface 6 inches, yet fail to grow corn without potash fertilization because so little of the potash they contain is available.

Total nitrogen is generally indicative of the needs for nitrogen, although some soils with low total nitrogen may have a supply of available nitrogen sufficient to grow a few large crops without nitrogen being added. Soils of low total nitrogen soon wear out as far as that element is concerned, unless the supply is replenished through the growth and return of legumes or the use of nitrogenous fertilizer.

The amount of total phosphorus in ordinary soils is usually about the same as that shown by a determination with strong acid. For this reason a separate determination of total phosphorus has been omitted. The supply of total phosphorus usually indicates the general needs of a soil for phosphorus fertilization, although there are exceptions to this.

The use of strong or weak acid in the analysis of a soil has sometimes been criticized as empirical, yet analyses made with strong or weak acids more often can be correlated with crop production than can an analysis of the total elements of the soil. For this reason acid solutions have been employed in these analyses.

*Chemical composition of Decatur County soils.*

[Elements in pounds per acre.]

Element.	No. 10, Miami loam.	No. 12, Miami silt loam, mott- led sub.	No. 13, Brook- ston silty clay loam.	No. 14, Clyde silty clay loam.	No. 6, Fox loam.	No. 7, Genesee loam.	No. 4, Cler- mont silt loam.	No. 11, Cincin- nati silt loam.	No. 5, Cincin- nati silt loam, broken phase.
Phosphorus <sup>1</sup> .....	1,135	699	1,659	2,444	1,484	1,834	786	1,135	699
Potassium <sup>1</sup> .....	1,660	1,328	2,490	4,317	1,992	2,656	1,162	1,162	1,992
Calcium <sup>1</sup> .....	3,859	3,144	16,151	16,437	5,145	29,158	3,144	2,572	2,287
Magnesium <sup>1</sup> .....	1,568	1,206	3,619	4,102	3,498	2,654	2,051	3,136	1,810
Manganese <sup>1</sup> .....	432	576	1,152	864	2,449	1,152	720	3,600	720
Iron <sup>1</sup> .....	35,669	35,000	24,479	29,234	41,824	38,747	26,437	41,000	50,700
Aluminum <sup>1</sup> .....	41,048	33,623	49,851	65,760	38,184	54,518	27,895	21,600	25,178
Sulphur <sup>1</sup> .....	640	640	880	1,840	800	560	400	640	480
Phosphorus <sup>2</sup> .....	44	26	96	183	44	79	35	44	35
Potassium <sup>2</sup> .....	282	149	216	315	232	515	183	298	414
Nitrogen <sup>3</sup> .....	3,000	1,800	4,400	5,800	3,600	3,600	2,000	2,400	2,000
Potassium <sup>3</sup> .....	39,513	40,841	40,675	31,212	31,876	36,524	28,887	32,800	28,721

<sup>1</sup> Soluble in strong hydrochloric acid (sp. gr. 1.15).

<sup>2</sup> Soluble in weak hydrochloric acid (fifth normal).

<sup>3</sup> Total elements determined by fusion method.

While it must be admitted that no one method will surely indicate what every soil may need, it is believed that with the exception of the total potassium the data shown in the foregoing table fairly represent the relative fertility of the different soils. If these soils are arranged from high to low in order of content of plant-food elements as shown by the analyses, the order will be as follows: Clyde, Genesee, Brookston, Fox, Miami, Miami, mottled subsoil phase, Clermont, and Cincinnati. The order will be approximately the same if the soils are arranged in relation to their natural fertility as shown by crop production on unfertilized land.

In interpreting the soil survey map it should be borne in mind that a well-farmed, well-fertilized, and manured soil of a type which is naturally low in fertility, will produce larger crops than a poorly farmed soil of a type naturally high in fertility. The better types of soils will stand hard treatment much longer than the less fertile types before crops begin to fail.

The nitrogen, phosphorus, and potassium content of a soil is by no means the only chemical indication of high or low fertility. One of the most important factors in soil fertility is the degree of acidity. Soils which are very acid will not produce well even when there is no lack of plant food. While nitrogen, phosphorus, and potassium are of some value on acid soils, they will not produce their full effect where lime is deficient. The following table shows the per cent of volatile matter and the acidity of the various soils found in the county. Samples were taken from the surface soil (0 to 6 inches), from the subsurface (6 to 18 inches), and from the subsoil (18 to 36 inches). It is important to know the reaction not only of the surface but of the lower layers of the soil. The table shows that the subsurface layers in all these soils are more acid than the surface. Such soils as the Miami, which here shows very little acidity in the surface, would undoubtedly grow better clover if limed, because of the acid subsoil. The Miami, mottled subsoil phase, the Clermont, and the Cincinnati soils all show a fairly high degree of acidity and all should show profitable increases if limed. The Brookston, Clyde, Fox, and Genesee types do not show enough acidity to need liming. The more organic or volatile matter a soil contains the less it needs lime in comparison with a soil of equal acidity low in organic matter.

*Volatile matter and acidity of Decatur County soils.*

No.	Type and location	Depth.	Volatile matter.	Acidity, pounds per acre. <sup>1</sup>
		<i>Inches.</i>	<i>Per cent.</i>	
1	Miami silt loam, S. 8., T. 10 N., R. 9 E .....	0-6	5.0	40
		6-18	4.1	1,000
		18-36	4.6	6,300

<sup>1</sup> Hopkins method.

*Volatile matter and acidity of Decatur County soils—Continued.*

No.	Type and location.	Depth.	Volatile matter.	Acidity, pounds per acre. <sup>1</sup>
		<i>Inches.</i>	<i>Per cent.</i>	
3	Miami silt loam, S. 33, T. 9 N., R. 8 E.....	0- 6	3.8	40
		6-18	3.4	160
		18-36	4.3	900
10	Miami silt loam, S. 28, T. 11 N., R. 9 E.....	0- 6	4.4	460
		6-18	3.9	1,160
		18-36	3.7	4,260
12	Miami silt loam, mottled subsoil, S. 3, T. 9 N., R. 9 E.....	0- 6	3.6	840
		6-18	3.8	6,440
		18-36	4.4	3,960
2	Brookston silty clay loam, S. 29, T. 9 N., R. 8 E.....	0- 6	8.3	Neutral.
		6-18	6.4	Do.
		18-36	5.0	Do.
8	Brookston silty clay loam, S. 6, T. 10 N., R. 9 E.....	0- 6	7.7	40
		6-18	4.9	40
		18-36	3.9	60
13	Brookston silty clay loam, S. 2, T. 10 N., R. 9 E.....	0- 6	7.2	100
		6-18	5.4	160
		18-36	4.6	240
14	Clyde silty clay loam, S. 29, T. 11 N., R. 9 E.....	0- 6	9.4	160
		6-18	6.5	240
		18-36	4.7	240
6	Fox loam, S. 5, T. 11 N., R. 9 E.....	0- 6	5.1	60
		6-18	4.7	120
		18-36		
7	Genesee loam, S. 12, T. 11 N., R. 8 E.....	0- 6	7.0	Neutral.
		6-18	5.1	Do.
		18-36	3.6	Do.
9	Genesee loam, S. 34, T. 11 N., R. 9 E.....	0- 6	4.6	Neutral.
		6-18	3.3	Do.
		18-36	1.9	Do.
4	Clermont silt loam, S. 31, T. 10 N., R. 11 E.....	0- 6	3.5	860
		6-18	2.5	5,800
		18-36	2.4	14,340
11	Cincinnati silt loam, S. 36, T. 10 N., R. 10 E.....	0- 6	4.6	1,780
		6-18	4.1	10,080
		18-36	3.9	30,960
5	Cincinnati silt loam, broken phase, S. 19, T. 10 N., R. 11 E..	0- 6	3.8	1,300
		6-18	3.9	10,480
		18-36	2.8	21,000

<sup>1</sup> Hopkins method.

## MIAMI SILT LOAM.

The Miami silt loam soil is usually most deficient in phosphorus, lime, nitrogen, and organic matter. Often it also needs some available potash. This is particularly true of the poorer phases and those tracts which have been heavily cropped without adequate returns of manure or other forms of plant food and organic matter.

*Organic matter and nitrogen.*—One of the important deficiencies of most of the soil of this type, and the one most difficult to remedy, is the lack of organic matter. The better parts of the type, particularly where the land has been well managed, are good, strong soils capable of producing good crops. In the majority of cases, however,

some constant and special effort must be made on the part of the farmer to provide organic matter, partly to improve the physical condition and handling qualities of the soil and partly to supply needed nitrogen. The nitrogen and organic matter needs go hand in hand. A soil that is low in organic matter is also low in nitrogen and vice versa. The organic matter needs can not be profitably supplied through purchased materials, and it is not practicable to supply much of the needed nitrogen in the form of commercial fertilizer, for ordinary farm crops at least. For some crops, especially wheat, some commercial nitrogen may be used at a profit, but the great bulk of the nitrogen needed must be provided through some other means.

The most practicable means of supplying both nitrogen and organic matter is to plow under considerable quantities of manure, crop residues, such as unused corn stalks or straw, and cover crops, especially clover or other legumes. Leguminous crops are the only ones that can really add nitrogen in large quantities to the soil, and then only to the extent to which top growth is plowed under directly or in the form of manure. Therefore, in planning crop rotations and systems of crop management with a view to supplying nitrogen, provision must be made for including clover or other legumes and returning these to the land in one form or another. A 60-bushel corn crop with 2 tons of stover and a 25-bushel wheat crop with 1 ton of straw require about 120 pounds of nitrogen for their production. If all of the produce except the wheat grain is utilized on the farm and the manure returned, about 60 pounds of nitrogen can be put back into the land. This leaves a shortage of 60 pounds of nitrogen to supply which would require a clover hay crop of 2 tons to be fed and the manure returned and a 1-ton second growth of clover for plowing under.

*Liming.*—A soil that needs lime to any considerable extent should usually have this need attended to as one of the first steps in its improvement. After harmful acidity is properly neutralized, the other needs of the soil can be most satisfactorily supplied. In fact, a very acid soil will not respond to other needed treatments until after it has been limed.

Most of the Miami silt loam of Decatur County is not much in need of liming so far as the surface soil is concerned, but the sub-surface is quite acid and such crops as clover and other deep-rooted legumes would be much benefited by liming. Since this soil needs legumes to supply nitrogen, it would be well to improve the conditions for their growth by giving it a moderate dressing of lime. An application of 2 tons of ground limestone per acre would doubtless be profitable. It would help clover at once, and ultimately enable the soil to produce larger crops of other kinds.



*Drainage.*—All of the Miami silt loam soil is in need of artificial drainage, though not so much so as the Clermont. Most of it has good surface drainage, but this is not sufficient for the best development of crops. The soil is fine in texture and the subsoil is so compact that surplus water does not readily drain away. Rain water should be absorbed by the soil, and the surplus should pass away through underdrains. Underdrainage increases the capacity of the soil to absorb rains and facilitates aeration, which is one of the things this soil needs to make it more productive. Tile-drained land of this kind can be worked much more satisfactorily and can be cultivated several days earlier after a heavy rain than land not tilled. Tile drainage should therefore be included in the program for the improvement of this type of soil. The tile lines should be laid not more than 4 rods apart and not less than 30 inches to 3 feet deep.

*Crop rotation.*—Probably the most generally practical rotation of crops on this type of soil is corn, wheat, clover. On the better phases of the type, especially where more corn is wanted for feeding operations, a 4-year rotation of corn, corn, wheat, clover may be practiced, planting soy beans with the first corn crop or drilling them between the corn rows at the time of the last cultivation, to be plowed under before seeding to rye as a catch crop to be plowed under for the second corn crop. Corn, soy beans, wheat, clover also makes a good rotation where a soy-bean seed crop can be utilized. Whatever rotation is followed, it should provide for enough leguminous material to be returned to the land either directly or in the form of manure to supply the nitrogen needed by the grain crops.

*Fertilization.*—A live-stock system of farming is best for this type of soil. At any rate, as much manure as possible should be made and applied to the land. Applying some of the manure, say 2 tons per acre, as a top dressing on wheat during the winter and plowing the rest under for corn is good practice. Besides supplying some plant food, such top dressing of wheat with manure has special advantages in that it helps to prevent winterkilling and makes it easier to secure a stand of clover. With proper attention to the maintenance of organic matter through the use of manure, legumes, and crop residues, as has been suggested, the bulk of the nitrogen needs can be taken care of.

All of the Miami silt loam soil is low in phosphorus and the poorer phases of the type are urgently in need of this element. There is only one way to supply phosphorus to the soil and that is to purchase and apply phosphatic fertilizers. As a general rule, from 200 to 300 pounds of acid phosphate or the equivalent in some other available phosphate should be applied for corn and at least 200



pounds of a 2-12-0,<sup>1</sup> 2-12-2, or 2-12-4 mixed fertilizer should be drilled with the wheat. These amounts of phosphorus will take care of the needs of any ordinary crop rotation. The nitrogen in the fertilizer suggested for wheat will be especially helpful where this crop follows corn. The amount of potash to apply will depend upon the general condition of the soil and the extent to which manure is used. The total supply of potash in the soil is large, but usually only a small amount is available. The availability of the soil potash can be materially helped by good farming, including proper tillage, drainage, the growing of legumes, and the incorporation of liberal amounts of organic matter. The better these practices are carried out and the more manure is used, the less potash will have to be purchased in fertilizer.

#### MIAMI SILT LOAM, MOTTLED-SUBSOIL PHASE.

The Miami silt loam, mottled-subsoil phase, is naturally a much poorer soil than the typical Miami silt loam. The requirements for its improvement are similar to the latter, but its needs are more pronounced. It is much lower in phosphorus, nitrogen, and organic matter, and its lime requirement is much higher. It also needs available potash to a greater degree than the typical soil. Liming should be attended to first by putting on at least 2 tons of ground limestone or the equivalent. Then, a greater proportion of clover or other legumes should be grown and as much organic matter as possible plowed under. Liberal applications of available phosphates should follow liming. These two treatments together with clover will soon improve productiveness. As much manure as possible should be made and returned to the land. Wheat should receive 200 to 300 pounds of high-grade complete fertilizer to the acre and corn about 300 pounds of acid phosphate. Tile drainage should also be included in the program for the improvement of this soil.

#### BROOKSTON SILTY CLAY LOAM.

Next to the Clyde and Genesee, the Brookston silty clay loam is naturally one of the richest soils of the county. Most of it is well supplied with organic matter and the nitrogen content is still high enough to meet the needs of crops, provided that clover or other legumes are included in the rotation and reasonable amounts of manure or crop residues are returned to the land. This can be easily done. The soil is not appreciably acid and will produce good crops of clover without liming. Most of the type is rather low lying and more or less in need of artificial drainage. Tile lines should be laid not more than 4 rods apart and at least 30 to 36 inches deep.

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<sup>1</sup> Formula stated in the order: Nitrogen, phosphoric acid, and potash.

*Crop rotation.*—All ordinary farm crops can be grown on this soil type. It is one of the best corn soils in the county, and also produces good crops of wheat and clover. In general farming it is therefore well adapted to a corn, wheat, clover rotation. Where live stock is fed and considerable manure made, a 4-year rotation of corn, corn, wheat, clover may be practiced with the addition of some phosphate fertilizer.

*Fertilization.*—As shown in the tables of analyses and already mentioned in the discussion of this soil type, the Brookston silty clay loam is naturally reasonably well supplied with organic matter and nitrogen. In most cases, therefore, it will be necessary only to maintain the available supplies of these constituents. This can be done by including clover in the rotation of crops and plowing under the unused crop residues and applying reasonable amounts of manure made from the produce harvested.

As regards phosphorus, the soil has a fair supply, but not enough to warrant farming the land without some phosphate fertilizer. It should probably receive 100 pounds per acre per year of acid phosphate or the equivalent in some other available phosphate or in manure. The phosphate may all be applied at one time for the rotation, as when seeding wheat, or it may be divided between the corn and wheat.

Where the land has been heavily cropped and little manure returned this soil may respond to potash fertilization. In such cases 4 per cent of potash in the wheat fertilizer might be used to advantage.

#### CLYDE SILTY CLAY LOAM.

The Clyde silty clay loam is naturally the richest soil in the county. Since there is relatively little of it and it appears only in spots in the same fields with Brookston silty clay loam, it may be treated along with the latter and generally managed in the same way. A few depressions inclined to be chaffy, which are included in this type as it is mapped, may need a little extra potash.

#### GENESEE LOAM.

In natural fertility, the Genesee loam may be classed with the Clyde and Brookston. It is fairly well supplied with organic matter and nitrogen and so far as keeping up these constituents is concerned it may be treated as has been suggested for the Brookston silty clay loam, especially where the overflow from high water is not sufficient to prohibit the growth of clover. Where there is any considerable overflow, the cropping system may have to be largely corn, with an occasional crop of spring small grain and grass.

The phosphorus supply of this soil is good, except where it has been exhaustively cropped, in which case it will respond to some phosphate fertilizer. The potash supply seems to be ample. Some areas of this type should probably have tile underdrainage.

#### FOX LOAM.

In natural fertility the Fox loam stands next to the Genesee loam. The organic matter and nitrogen supplies need to be more carefully watched. Clover or other legumes should be included in the crop rotation. As much manure as possible should be applied and all unused corn stalks, straw, and other crop residues should be plowed under.

The phosphorus supply of this soil is considerably lower than that of the Clyde, Brookston, or Genesee, and applications of phosphatic fertilizer should probably average at least a half more than on the latter soils. It may also respond to a little potash, unless plenty of manure is used.

The Fox loam is well adapted to all kinds of crops suited to the local climatic conditions. It is the best truck-crop soil in the county. As a rule, artificial drainage is not necessary.

#### BELLEFONTAINE LOAM.

The Bellefontaine loam is represented by only a few small areas in Decatur County and should generally be treated the same as the Miami silt loam or Fox loam with which it is associated.

#### CLERMONT SILT LOAM.

The Clermont silt loam is naturally one of the poorest soils in the county and requires considerable special treatment to make it productive. Poor drainage, excessive acidity, and shortage of phosphorus, nitrogen, and organic matter are all important defects. Usually this soil type also requires some available potash. Practical and profitable means of remedying these defects have been worked out by the Purdue University Agricultural Experiment Station on the Westport and North Vernon experiment fields. The results of the experiments on these fields clearly show that by proper tile drainage, liming, the use of clover or other legumes in the rotation, applying the manure that can be made from the produce and 300 to 400 pounds of acid phosphate per rotation, together with a little available nitrogen and potash for wheat, this soil can be made to produce large crops at a good profit.

On the North Vernon experiment field, which is located on this soil type, a total expenditure of \$63 an acre for drainage, ground

limestone, and fertilizer between the years 1912 and 1920 has produced total crop increases worth \$230 at the average farm prices of the produce during this period in a corn, wheat, clover rotation. The average crop yields produced by this treatment have been 77.5 bushels of corn, 24.4 bushels of wheat, and 4,160 pounds of hay per acre.

*Drainage.*—The first requisite in improving the Clermont silt loam is thorough tile drainage. Without tile drainage this land can not be satisfactorily managed and no other soil treatment can produce its full effect. Experience on the Westport and North Vernon experiment fields indicates that tile lines laid 3 rods apart and 30 inches deep will give excellent results. Whether or not closer tiling would be more profitable, considering the money invested, remains to be seen. Experiments to determine this are now underway. Since most of this land is very flat, great care must be exercised in tiling it to secure an even grade and uniform fall. No grades should be established by guess or any rule of thumb method. Nothing less accurate than a surveyor's instrument should be used and all lines should be accurately staked and leveled before beginning to cut the ditches to make sure that all the water will flow to the outlet without interruption or slackening of the current. The rate of fall may be increased toward the outlet, but it should never be lessened. Checking of the current may cause the tile to fill with silt and choke. Several unsatisfactory experiences in tiling this land have been reported and some believe that it can not be satisfactorily tiled. Failures are doubtless due to improper grading of the tile lines, causing them to fill up in places. The land is very silty and will drain readily if the tile lines are properly constructed. It is an excellent plan to cover the tile with a few inches of straw, or weeds or grass cut from the field, before filling in the ditches with earth. This prevents silt from washing into the tile while the ground is settling and insures perfect operation of the tile from the beginning.

*Liming.*—The Clermont is one of the most acid soils in the county and must be thoroughly limed before other treatments can produce the best results. Liming should therefore be one of the first treatments. As a rule 3 tons of ground limestone per acre will be required as a first application, after that 1 or 2 tons per acre every second or third round of the rotation will keep the land in a reasonably sweet condition. The profitableness of liming this type of soil has been well demonstrated on the Westport and North Vernon experiment fields. The results of the experiments on these fields can be obtained from the Purdue University Agricultural Experiment Station.



*Organic matter and nitrogen.*—The Clermont silt loam is lowest in organic matter of all the soils in the county. Building up the supply of this constituent must be the first thing undertaken after drainage and the application of lime and phosphate. A liberal use of clover or other legumes in the rotation, coupled with returning to the land as much as possible of the produce, either directly or in the form of manure, is the most practical means of increasing both the organic matter and nitrogen. On the North Vernon field on this soil type, clover instead of timothy in the rotation with corn and wheat has increased the average crop yields by 7 bushels of corn, 4.3 bushels of wheat, and 1,210 pounds of hay per acre. Returning the manure made from the corn, hay, and straw has increased the average crop yields by 17.7 bushels of corn, 6.5 bushels of wheat, and 411 pounds of hay.

*Crop rotation.*—With tile drainage, liming, and proper fertilization, this soil will satisfactorily produce all the ordinary farm crops adapted to the locality. On account of the organic matter and nitrogen shortage, however, every system of cropping should include clover or some other legume to be returned to the land in one form or another. Corn, wheat, clover or mixed clover and timothy makes a good standard rotation for this land. If the corn can be cut and the land disked for wheat seeding, so much the better. Rye may be substituted for the wheat. Soy beans will also do well on this land when tile drained, limed, and treated with phosphates.

*Fertilization.*—In the table showing the chemical composition of the soils of the county, it is seen that the Clermont silt loam is particularly low in phosphorus and nitrogen. The natural supply of nitrogen in the soil is already much too low and should not be further drawn upon. On the contrary, it should be materially increased. The problem of supplying needed nitrogen has been discussed in connection with provisions for supplying organic matter. Legumes and manure are the logical and only really practical means of supplying the bulk of the nitrogen needed and should be largely relied upon for this purpose. However, in the beginning at least, it will pay to include some nitrogen in the fertilizer for wheat, particularly where this crop follows corn.

Phosphorus is the plant-food element most deficient in this soil and the supply is much too low to meet the needs of even fair crops. It is, in fact, so low that the entire needs of crops should be supplied from outside sources. A rotation of corn, wheat, and clover, yielding 75 bushels of corn, 25 bushels of wheat, and 2 tons of clover hay, requires 80 pounds of phosphoric acid. If all the produce except the wheat grain were utilized on the farm and the manure returned, about 35 pounds of phosphoric acid could be put back into the land.

This would leave a deficit of 45 pounds to be supplied in the form of fertilizer for each round of the rotation. From 200 to 250 pounds per acre of 16 per cent acid phosphate applied for corn and 200 pounds of 2-12-4 mixed fertilizer for the wheat would meet the need and allow a little for unavoidable waste. Such treatment has actually produced the yields on the North Vernon experiment field cited in a preceding paragraph as the average of the last seven years, and the profits have been highly satisfactory.

The total potash supply in the soil is large and would be ample if it could be made available. However, the availability is low and potash used in fertilizer has paid well on both the New Point and North Vernon experiment fields. At least 4 per cent of potash in the wheat fertilizer can be used at a profit.

The experiments on this type of soil have clearly shown that with proper treatment it can be farmed very satisfactorily and made to produce highly profitable crops.

#### CINCINNATI SILT LOAM.

The Cincinnati silt loam is considerably more acid than the Clermont and needs more lime. Its natural drainage is better and tiling is not so necessary, but much of it should be underdrained as rapidly as possible. Erosion is an important factor on this soil and special precautions against it are necessary wherever there is any considerable slope. The rougher phases of the type should not be plowed any more than necessary. Grasses and other crops that will hold the soil in place should be used as much as possible. Japan clover and, after proper liming, sweet clover also can be used to advantage on the slopes and in the gullies. Filling the washes with straw and trash, plowing across the slopes and terracing are practical means of preventing erosion.

As regards fertilization and providing organic matter, this soil should be treated much the same as the Clermont.



[PUBLIC RESOLUTION—No. 9.]

JOINT RESOLUTION Amending public resolution numbered eight, Fifty-sixth Congress, second session, approved February twenty-third, nineteen hundred and one, "providing for the printing annually of the report on field operations of the Division of Soils, Department of Agriculture."

*Resolved by the Senate and House of Representatives of the United States of America in Congress assembled*, That public resolution numbered eight, Fifty-sixth Congress, second session, approved February twenty-third, nineteen hundred and one, be amended by striking out all after the resolving clause and inserting in lieu thereof the following:

That there shall be printed ten thousand five hundred copies of the report on field operations of the Division of Soils, Department of Agriculture, of which one thousand five hundred copies shall be for the use of the Senate, three thousand copies for the use of the House of Representatives, and six thousand copies for the use of the Department of Agriculture: *Provided*, That in addition to the number of copies above provided for there shall be printed as soon as the manuscript can be prepared, with the necessary maps and illustrations to accompany it, a report on each area surveyed, in the form of advance sheets, bound in paper covers, of which five hundred copies shall be for the use of each Senator from the State, two thousand copies for the use of each Representative for the congressional district or districts in which the survey is made, and one thousand copies for use of the Department of Agriculture.

Approved, March 14, 1904.

[On July 1, 1901, the Division of Soils was reorganized as the Bureau of Soils.]



Areas surveyed in Indiana, shown by shading.



# Accessibility Statement

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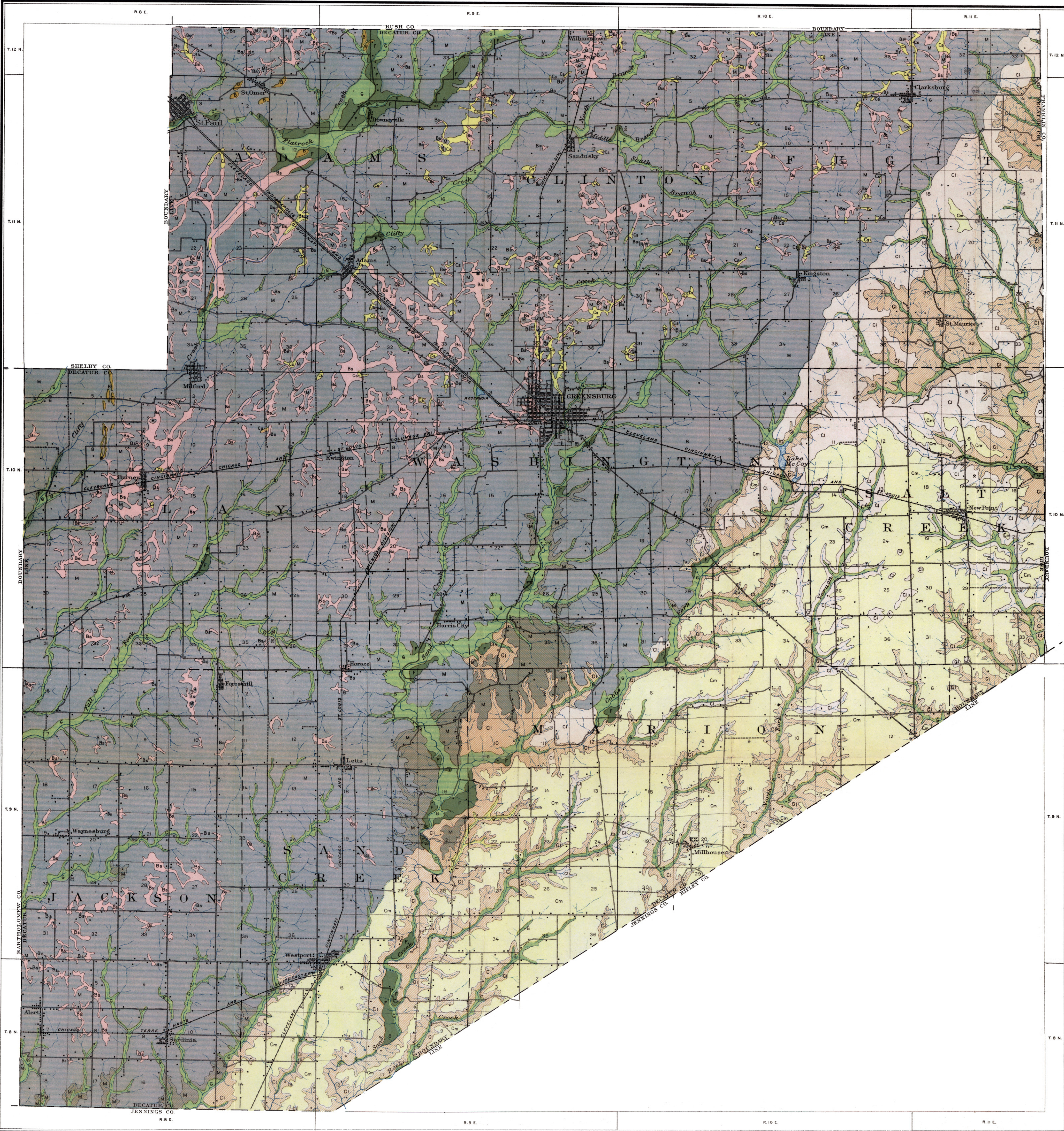
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LEGEND

- |                           |                       |
|---------------------------|-----------------------|
| Bellefontaine loam        | Fox loam              |
| Brookston silty clay loam | Genesee loam          |
| Cincinnati silt loam      | Miami silt loam       |
| Broken phase              | Rolling phase         |
| Clermont silt loam        | Mottled-subsoil phase |
| Clyde silty clay loam     |                       |

CONVENTIONAL SIGNS

- CULTURE  
(Printed in black)
- City or Village, Roads, Buildings, Wharves, Jetties, Buoys, Levees, Lighthouse, Fort.
- Secondary roads and Trails
- Bridges, Ferry
- Ford, Dam
- Mine or Quarry
- Stony and Gravelly areas
- Boundary lines
- Boundary lines
- Boundary lines
- RELIEF  
(Printed in brown or black)
- Contours
- Depression contours
- Sand Wash and Sand dunes
- DRAINAGE  
(Printed in blue)
- Streams
- Intermittent streams
- Swamp
- Salt marshes
- Railroads and Electric
- R.R. crossings, Tunnel
- School or Church
- Cemeteries
- Bluff Escarpment
- Rock outcrop and Triangulation station
- Soil boundaries
- LAND GRANT
- CITY OR VILLAGE
- BOUNDARY LINES
- U.S. township and section lines
- Mountain Peaks
- Lakes, Ponds, Intermittent lakes
- Spring, Canals and Ditches, Flumes
- Submerged marsh
- Tidal flats

W. E. McLendon, Inspector Northern Division,  
Soils surveyed by Mark Baldwin, in charge,  
and J. A. Sliemers of the U.S. Department  
of Agriculture and S. C. Jones of the Purdue  
University Agricultural Experiment Station.

Scale 1 inch = 1 mile

Field Operations  
Bureau of Soils  
1919.